

WHAT IS CLAIMED IS:

1. A method of writing new data in a flash memory, the flash memory being divided into sectors, each sector being completely erasable in a time T, the new data replacing data stored in a first sector in the flash memory, the method comprising:

erasing at least N sectors in the flash memory simultaneously for a time U less than the time T, where N is an integer greater than one, the first sector being one of the at least N sectors;

selecting a second sector in the flash memory, the second sector having already been fully erased by being erased N times, each time for the time U; and

writing the new data in the second sector.

2. The method of claim 1, wherein the at least N sectors are erased after the new data have been written in the second sector.

3. The method of claim 1, further comprising repeating said erasing, said selecting, and said writing N - 1 additional times with different new data, the first sector being erased each of the N - 1 additional times.

4. The method of claim 1, wherein the sectors in the flash memory include a plurality of data sectors and at least 2N buffer sectors, the second sector being one of the buffer sectors, the at least N sectors erased for the time U including N of the buffer sectors and up to N of the data sectors.

5. The method of claim 4, further comprising transferring data from another one of the buffer sectors to another one

of the data sectors, provided the data to be transferred have not been supplanted by newer data stored in still another one of the buffer sectors.

6. The method of claim 4, further comprising:

writing an address of the first sector in the second sector, indicating that the new data written in the second sector are awaiting transfer to the first sector;

checking addresses that were written in those of the buffer sectors, other than the second sector, that hold data awaiting transfer to the data sectors;

setting a duplication flag in any buffer sector, other than the second sector, holding data awaiting transfer to the first sector, to indicate that the data being held are no longer valid; and

transferring data from a third sector to a fourth sector, the third sector being one of the buffer sectors, the fourth sector being one of the data sectors, the address of the fourth sector being written in the third sector, provided the data in the third sector are still valid.

7. The method of claim 6, wherein the duplication flag is set after the new data have been written in the second sector.

8. The method of claim 4, further comprising:

writing the address of the first sector in an address latch storing addresses of data sectors to be erased;

setting a first flag in the address latch after the new data have been written in the second sector, to indicate that the data in the second sector are valid; and

clearing a second flag in the address latch, if one of the buffer sectors other than the second sector is found to hold older data awaiting transfer to the first sector, to

indicate that the older data are no longer valid.

9. The method of claim 1, wherein the sectors in the flash memory have physical addresses and the new data has a logical address, the method further comprising reassigning the logical address of the new data from the first sector to the second sector.

10. The method of claim 9, further comprising writing the physical address of the second sector in an address management memory at a location corresponding to the logical address of the new data.

11. The method of claim 9, further comprising writing the physical address of the first sector in an erase buffer storing the physical addresses of sectors that are being erased or have been fully erased, wherein selecting the second sector further comprises checking the erase buffer to find the physical address of a data sector that has been fully erased.

12. The method of claim 11, wherein the erase buffer comprises at least two of the sectors of the flash memory, and erasing at least N sectors further includes:

- erasing N sectors having physical addresses stored in the erase buffer; and

- erasing at least one of the sectors in the erase buffer.

13. The method of claim 9, further comprising:

- checking the second sector after writing the new data;

- setting a bad sector flag in the second sector if a write error has occurred;

- selecting a third sector in the flash memory if a write error has occurred, the third sector having already been

fully erased by being erased N times, each time for the time U ; and

writing the new data in the third sector.

14. A method of writing new data in a flash memory including a flash data memory having at least N data sectors, N being an integer greater than one, and a flash buffer having $2N$ buffer sectors, the data sectors and the buffer sectors being erasable in a time T , the flash memory forming part of a data rewriting apparatus that also includes, either as part of the flash memory or separately from the flash memory, a sector management device having N sector management areas for storing addresses of data sectors in the flash data memory, the method comprising:

writing the address of a first data sector in a first sector management area, the first data sector being one of the at least N data sectors, the first sector management area being one of the N sector management areas;

writing first new data in a first buffer sector, the first buffer sector being one of the $2N$ buffer sectors;

erasing N of the buffer sectors for a time U equal to T/N , while also erasing the first data sector for the time U if the first data sector stores data, the erasing process completely erasing a second buffer sector among the N of the buffer sectors;

repeating said steps of writing addresses and data and erasing N times with different addresses, thereby leaving the first data sector in a completely erased state;

transferring the first new data from the first buffer sector to the first data sector; and

erasing the data sectors having addresses written in the N sector management areas for said time U and erasing another N of the buffer sectors for said time U , the erased buffer sectors excluding the first buffer sector and the

buffer sectors storing the data written during the above repetitions of the steps of writing addresses and data, thereby leaving at least one data sector and at least one buffer sector in a completely erased state.

15. The method of claim 14, further comprising:

deciding whether the address of the first data sector is already stored in one of the N sector management areas; and

setting flags to mark each sector management area already storing the address of the first data sector and each corresponding buffer sector, the address stored in each sector management area thus marked being regarded as invalid, the data stored in each buffer sector thus marked not being transferred to the flash data memory.

16. The method of claim 14, wherein the sector management device includes both volatile sector management areas and non-volatile sector management areas, further comprising:

deciding whether the address of the first data sector is already stored in one of the volatile sector management areas; and

setting a flag to mark each sector management area already storing the address of the first data sector; and

setting a flag to mark each non-volatile sector management area already storing the address of the first data sector after writing the first new data in the first buffer sector; wherein

the address stored in each volatile or non-volatile sector management area thus marked is regarded as invalid;

each buffer sector has a corresponding volatile sector management area and a corresponding non-volatile sector management area; and

the data stored in each buffer sector are transferred

to the flash data memory only if the address stored in the corresponding sector management areas is valid.

17. The method of claim 14, further comprising:

receiving a read address;

deciding whether the read address is stored in the sector management device;

reading data from the flash buffer if the read address is stored in the sector management device.

reading data from the flash data memory if the read address is not stored in the sector management device.

18. A data rewriting apparatus including a flash memory with at least N extra sectors, data in the flash memory being rewritten by the method of claim 14.

19. A method of writing new data in a flash memory having at least $N + 1$ data sectors, N being an integer greater than one, the data sectors being erasable in a time T , the flash memory forming part of a data rewriting apparatus that also includes, either as part of the flash memory or separately from the flash memory, an address management device and a sector management device, the address management device being divided into address management areas corresponding to logical addresses assignable to arbitrary data sectors in the flash memory, each address management area storing a physical address of the data sector to which the corresponding logical address is thereby assigned, the sector management device including at least $N + 1$ sector management areas for storing physical addresses of data sectors in the flash memory, the data sectors including a first data sector storing data and a second data sector that is completely erased, the physical address of the second data sector being stored in one of the sector management

areas in the sector management device, the method comprising:

- receiving new data and a first logical address, the first logical address corresponding to a first address management area storing the physical address of the first data sector;

- writing the new data in the second data sector;

- writing the physical address of the first data sector in another one of the sector management areas in the sector management device;

- writing the physical address of the second data sector in the first address management area; and

- erasing N of the data sectors having physical addresses stored in the sector management device for a time U equal to T/N , the N of the data sectors including the first data sector but not including the second data sector, thereby completely erasing a third data sector among the N of the data sectors.

20. The method of claim 19, further comprising:

- reading the new data from the second data sector to check that the new data have been written correctly in the second sector;

- setting a flag to mark the second data sector as invalid if the new data have not been written correctly therein; and

- writing the new data in a fourth data sector that is completely erased and has a physical address stored in the sector management device, if the new data were not written correctly in the second data sector.

21. The method of claim 19, further comprising:

- receiving a second logical address; and

- reading data from a data sector having a physical

address stored in the address management area corresponding to the second logical address.

22. A data rewriting apparatus including a flash memory with at least one extra data sector, data in the flash memory being rewritten by the method of claim 19.